

REMARKS

Amendments to Specification

The specification has been amended to correct typographical errors. Applicant respectfully submits that no new matter has been introduced by these amendments and that the specification is currently in condition for allowance.

Claim Objections

Examiner has objected to Claims 1-22, asserting that the phrase “lower adhesion-promoting layer lower Ti barrier layer” requires correction.

Claim 1 has been amended so that the phrase “lower adhesion-promoting layer lower Ti barrier layer” now reads “lower adhesion-promoting layer.”

Therefore, Applicant respectfully submits that Claims 1-22 are currently in condition for allowance. Reconsideration and withdrawal of the objection is respectfully requested.

Claim Rejections – 35 U.S.C. §112

Claim 41 stands rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Since Claim 41 has been canceled, Applicant respectfully submits that Examiner’s rejection is moot.

Claim Rejections – 35 U.S.C. §103

Claims 1-2, 13, 16, 23, 29 and 40-46 stand rejected under 35 U.S.C. §103(a) as being unpatentable over McCollum (US 5,789,764) in view of Takagi et al. (US 5,550,400).

For a §103 obviousness rejection to be proper, the Examiner must meet the burden of establishing that all elements of the invention are disclosed in the prior art; that the prior art relied upon, coupled with knowledge generally available in the art at the time of the invention, must contain some suggestion or incentive that would have motivated the skilled artisan to modify a reference or combined references; and that the proposed modification of the prior art must have had a reasonable expectation of success, determined from the vantage point of the skilled artisan at the time the invention was made. MPEP 2143.

Claim 1 recites a reprogrammable metal-to-metal antifuse comprising “... a lower Ti barrier layer disposed over said metal plug; a lower adhesion-promoting layer disposed over said lower Ti barrier layer; an antifuse material layer disposed above an upper surface of said lower adhesion-promoting layer, said antifuse material layer selected from a group comprising at least one of amorphous carbon and amorphous carbon doped with at least one of hydrogen and fluorine disposed over said lower adhesion-promoting layer; an upper adhesion-promoting layer disposed over said antifuse material layer; and an upper Ti barrier layer disposed over said upper adhesion-promoting layer.”

McCollum fails to disclose the lower and upper Ti barrier layers disposed under and over the lower and upper adhesion-promoting layers as recited in Claim 1. On Page 3 of the Office Action dated September 15, 2005, Examiner even admits that McCollum does not teach these limitations. However, Examiner asserts that Takagi teaches the lower and upper Ti barrier layers and that it would have been obvious to a person ordinarily skilled in the art to use the lower and upper Ti barrier layers under and over the antifuse in McCollum’s device in order to improve the adhesion of the layers in the device.

Applicant respectfully submits that there is no suggestion or incentive that would motivate one skilled in the art to use the lower and upper Ti barrier layers of Takagi in McCollum's device. Although Examiner asserts that the motivation would be to improve the adhesion of the layers in the device, Applicant cannot find, nor has Examiner cited, any mention in Takagi of the lower and upper Ti barrier layers improving the adhesion of the layers in the device. As stated in MPEP 2144.03(A), it "is never appropriate to rely solely on common knowledge in the art without evidentiary support in the record, as the principal evidence upon which a rejection was based." Broad conclusory statements standing alone are not evidence. MPEP 2144.03(C). Applicant respectfully requests that Examiner provide evidence of this asserted motivation or otherwise withdraw the rejection.

Since Examiner has failed to establish that the cited prior art contains some suggestion or incentive that would have motivated the skilled artisan to modify the invention in McCollum to include the Ti barrier layers of Takagi, Applicant respectfully submits that Claim 1 is non-obvious and patentable over McCollum in view of Takagi.

Since Claims 2, 13 and 16 depend from Claim 1, Applicant respectfully submits that Claims 2, 13 and 16 are also patentable as they contain the same limitations as Claim 1.

Applicant respectfully submits that the same arguments made above with respect to the patentability of Claim 1 are applicable to the patentability of Claim 23 as well.

Since Claim 29 depends from Claim 23, Applicant respectfully submits that Claim 29 is also patentable as it contains the same limitations as Claim 23.

Claim 40 recites a method for programming and erasing a reprogrammable metal-to-metal antifuse, comprising "programming said antifuse by applying a programming potential across said antifuse to cause a programming current to flow through said

antifuse until its resistance substantially decreases; and erasing said antifuse by applying an erasing potential across said antifuse, said erasing potential being lower in magnitude than said programming potential and causing an erase current to flow through said antifuse.”

Examiner asserts that it would have been obvious to one ordinarily skilled in the art to program and erase a reprogrammable metal-to-metal antifuse using the steps recited in Claim 40 in order to operate the device in its intended use. However, Examiner has not provided or cited any evidence to support this argument. As stated in MPEP 2144.03(A), it “is never appropriate to rely solely on common knowledge in the art without evidentiary support in the record, as the principal evidence upon which a rejection was based.” Broad conclusory statements standing alone are not evidence. MPEP 2144.03(C). It is respectfully requested that evidence be provided, if possibly citable from the prior art, to prove that the prior art teaches all of the limitations of Claim 40, or the rejection must be withdrawn. Therefore, Applicant respectfully submits that Examiner has failed to establish that the prior art discloses all of the elements of Claim 40 and that there is some incentive or suggestion that would motivate one skilled in the art to modify the prior art in order to arrive at the claimed invention.

Since Claims 42-46 depend from Claim 40, Applicant respectfully submits that Claims 42-46 are also patentable as they contain the same limitations as Claim 40. Since Claim 41 has been canceled, Applicant respectfully submits that Examiner’s rejection of Claim 41 is moot.

Applicant respectfully submits that Claims 1-2, 13, 16, 23, 29, 40, and 42--46 are currently in condition for allowance. Reconsideration and withdrawal of the rejection is respectfully requested.

Claims 14-15 and 30-31 stand rejected under 35 U.S.C. §103(a) as being unpatentable over McCollum and Takagi, and further in view of Liu et al. (“A New Metal-to-Metal Antifuse with Amorphous Carbon,” IEEE Electron Device Letters, Vol. 19, No. 9, (1998), pp. 317-319).

Since Claims 14-15 depend from Claim 1, Applicant respectfully submits that Claims 14-15 are also patentable as they contain the same limitations as Claim 1.

Since Claims 30-31 depend from Claim 23, Applicant respectfully submits that Claims 30-31 are also patentable as they contain the same limitations as Claim 23.

Applicant respectfully submits that Claims 14-15 and 30-31 are currently in condition for allowance. Reconsideration and withdrawal of the rejection is respectfully requested.

Claims 1-3, 6-8, 11-17, 20-22, 29, 34 and 40-46 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Forouhi (US 5,181,096) in view of Liu.

Amended Claim 1 recites a reprogrammable metal-to-metal antifuse comprising “an inter-metal dielectric layer having a via formed therethrough and filled with a metal plug ....”

Forouhi and Liu fail to disclose an inter-metal dielectric layer having a via formed therethrough and filled with a metal plug, as recited in Claim 1. On Page 9 of the Office Action dated September 15, 2005, Examiner even admits that Forouhi and Liu do not teach these limitations. However, Examiner asserts that McCollum teaches this inter-metal dielectric layer and that it would have been obvious to a person ordinarily skilled in the art to use this inter-metal dielectric layer in Forouhi and Liu’s device in order to use the device in a practical application.

Applicant respectfully submits that there is no suggestion or incentive that would motivate one skilled in the art to use the inter-metal dielectric layer of McCollum in Forouhi and Liu's device. Although Examiner asserts that the motivation would be to use the device in a practical application, it is unclear what Examiner is referring to as the practical application. Examiner has made a vague assertion of practical application without defining or in any way explaining this practical application. Furthermore, Applicant cannot find, nor has Examiner cited, any mention in the prior art of the inter-metal dielectric layer providing this practical application. As stated in MPEP 2144.03(A), it "is never appropriate to rely solely on common knowledge in the art without evidentiary support in the record, as the principal evidence upon which a rejection was based." Broad conclusory statements standing alone are not evidence. MPEP 2144.03(C). Applicant respectfully requests that Examiner provide evidence of this asserted practical application and how the cited inter-metal dielectric layer provides this practical application or otherwise withdraw the rejection.

Since Examiner has failed to establish that the cited prior art contains some suggestion or incentive that would have motivated the skilled artisan to modify the invention in Forouhi and Liu to include the inter-metal dielectric layer of McCollum, Applicant respectfully submits that Claim 1 is non-obvious and patentable over the cited prior art.

Since Claims 2-3, 6-8, 11-17, and 20-22 depend from Claim 1, Applicant respectfully submits that Claims 2-3, 6-8, 11-17, and 20-22 are also patentable as they contain the same limitations as Claim 1.

Since Claims 29 depends from Claim 23, Applicant respectfully submits that Claim 29 is also patentable as it contains the same limitations as Claim 23.

Applicant respectfully submits that the same arguments made above with respect to the patentability of Claim 1 are applicable to the patentability of Claim 34 as well.

Claim 40 recites a method for programming and erasing a reprogrammable metal-to-metal antifuse, comprising “programming said antifuse by applying a programming potential across said antifuse to cause a programming current to flow through said antifuse until its resistance substantially decreases; and erasing said antifuse by applying an erasing potential across said antifuse, said erasing potential being lower in magnitude than said programming potential and causing an erase current to flow through said antifuse.”

Examiner asserts that it would have been obvious to one ordinarily skilled in the art to program and erase a reprogrammable metal-to-metal antifuse using the steps recited in Claim 40 in order to operate the device in its intended use. However, Examiner has not provided or cited any evidence to support this argument. As stated in MPEP 2144.03(A), it “is never appropriate to rely solely on common knowledge in the art without evidentiary support in the record, as the principal evidence upon which a rejection was based.” Broad conclusory statements standing alone are not evidence. MPEP 2144.03(C). It is respectfully requested that evidence be provided, if possibly citable from the prior art, to prove that the prior art teaches all of the limitations of Claim 40, or the rejection must be withdrawn. Therefore, Applicant respectfully submits that Examiner has failed to establish that the prior art discloses all of the elements of Claim 40 and that there is some incentive or suggestion that would motivate one skilled in the art to modify the prior art in order to arrive at the claimed invention.

Since Claims 42-46 depend from Claim 40, Applicant respectfully submits that Claims 42-46 are also patentable as they contain the same limitations as Claim 40. Since

Claim 41 has been canceled, Applicant respectfully submits that Examiner's rejection of Claim 41 is moot.

Applicant respectfully submits that Claims 1-3, 6-8, 11-17, 20-22, 29, 34, 40, and 42-46 are currently in condition for allowance. Reconsideration and withdrawal of the rejection is respectfully requested.

Claims 23-24 and 27-32 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Forouhi and Liu, and further in view of McCollum.

Claim 23 recites a reprogrammable metal-to-metal antifuse comprising "... an inter-metal dielectric layer having a via formed therethrough and filled with a metal plug ...."

Forouhi and Liu fail to disclose an inter-metal dielectric layer having a via formed therethrough and filled with a metal plug, as recited in Claim 23. On Page 9 of the Office Action dated September 15, 2005, Examiner even admits that Forouhi and Liu do not teach these limitations. However, Examiner asserts that McCollum teaches this inter-metal dielectric layer and that it would have been obvious to a person ordinarily skilled in the art to use this inter-metal dielectric layer in Forouhi and Liu's device in order to use the device in a practical application.

Applicant respectfully submits that there is no suggestion or incentive that would motivate one skilled in the art to use the inter-metal dielectric layer of McCollum in Forouhi and Liu's device. Although Examiner asserts that the motivation would be to use the device in a practical application, it is unclear what Examiner is referring to as the practical application. Examiner has made a vague assertion of practical application without defining or in any way explaining this practical application. Furthermore, Applicant cannot find, nor has Examiner cited, any mention in the prior art of the inter-

metal dielectric layer providing this practical application. As stated in MPEP 2144.03(A), it “is never appropriate to rely solely on common knowledge in the art without evidentiary support in the record, as the principal evidence upon which a rejection was based.” Broad conclusory statements standing alone are not evidence. MPEP 2144.03(C). Applicant respectfully requests that Examiner provide evidence of this asserted practical application and how the cited inter-metal dielectric layer provides this practical application or otherwise withdraw the rejection.

Since Examiner has failed to establish that the cited prior art contains some suggestion or incentive that would have motivated the skilled artisan to modify the invention in Forouhi and Liu to include the inter-metal dielectric layer of McCollum, Applicant respectfully submits that Claim 23 is non-obvious and patentable over the cited prior art.

Since Claims 24 and 27-32 depend from Claim 23, Applicant respectfully submits that Claims 24 and 27-32 are also patentable as they contain the same limitations as Claim 23.

Applicant respectfully submits that Claims 23-24 and 27-32 are currently in condition for allowance. Reconsideration and withdrawal of the rejection is respectfully requested.

Claims 4-5, 9-10, 18-19, and 33 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Forouhi and Liu, and further in view of Han (US 6,583,953).

Since Claims 4-5, 9-10 and 18-19 depend from Claim 1, Applicant respectfully submits that Claims 4-5, 9-10 and 18-19 are also patentable as they contain the same limitations as Claim 1.

Amended Claim 33 recites a reprogrammable metal-to-metal antifuse comprising “an inter-metal dielectric layer having a via formed therethrough and filled with a metal plug ....”

Forouhi, Liu and Han fail to disclose an inter-metal dielectric layer having a via formed therethrough and filled with a metal plug, as recited in Claim 33. On Page 9 of the Office Action dated September 15, 2005, Examiner even admits that Forouhi and Liu do not teach these limitations. However, Examiner asserts that McCollum teaches this inter-metal dielectric layer and that it would have been obvious to a person ordinarily skilled in the art to use this inter-metal dielectric layer in Forouhi and Liu’s device in order to use the device in a practical application.

Applicant respectfully submits that there is no suggestion or incentive that would motivate one skilled in the art to use the inter-metal dielectric layer of McCollum in Forouhi, Liu and Han’s device. Although Examiner asserts that the motivation would be to use the device in a practical application, it is unclear what Examiner is referring to as the practical application. Examiner has made a vague assertion of practical application without defining or in any way explaining this practical application. Furthermore, Applicant cannot find, nor has Examiner cited, any mention in the prior art of the inter-metal dielectric layer providing this practical application. As stated in MPEP 2144.03(A), it “is never appropriate to rely solely on common knowledge in the art without evidentiary support in the record, as the principal evidence upon which a rejection was based.” Broad conclusory statements standing alone are not evidence. MPEP 2144.03(C). Applicant respectfully requests that Examiner provide evidence of this asserted practical application and how the cited inter-metal dielectric layer provides this practical application or otherwise withdraw the rejection.

Since Examiner has failed to establish that the cited prior art contains some suggestion or incentive that would have motivated the skilled artisan to modify the invention in Forouhi, Liu and Han to include the inter-metal dielectric layer of McCollum, Applicant respectfully submits that Claim 33 is non-obvious and patentable over the cited prior art.

Applicant respectfully submits that Claims 4-5, 9-10, 18-19, and 33 are currently in condition for allowance. Reconsideration and withdrawal of the rejection is respectfully requested.

Claims 25-26 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Forouhi, Liu and McCollum, and further in view of Han.

Since Claims 25-26 depend from Claim 23, Applicant respectfully submits that Claims 25-26 are also patentable as they contain the same limitations as Claim 23.

Applicant respectfully submits that Claims 25-26 are currently in condition for allowance. Reconsideration and withdrawal of the rejection is respectfully requested.

Respectfully submitted,  
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